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Taxonomic Paper

Taxonomy and Biogeography without frontiers - WhatsApp, Facebook and smartphone digital photography let citizen scientists in more remote localities step out of the dark

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Abstract

Background

Taxonomy and biogeography can benefit from citizen scientists. The use of social networking and open access cooperative publishing can easily connect naturalists even in more remote areas with in-country scientists and institutions, as well as those abroad. This enables taxonomic efforts without frontiers and at the same time adequate benefit sharing measures.

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New information

We present new distribution and habitat data for diving beetles of Bali island, Indonesia, as a proof of concept. The species *Hydaticus luczonicus* Aubé, 1838 and *Eretes griseus* (Fabricius, 1781) are reported from Bali for the first time. The total number of Dytiscidae species known from Bali is now 34.

Keywords

Citizen Science, taxonomy, parataxonomists, handphone technology, internet, social media, diving beetles, Bali

Introduction

Citizen science (CS) is a currently much promoted and well-funded approach that seeks to stimulate the public to support scientists and *vice versa* (e.g. www.citizen-science-germany.de; www.buergerschaffenwissen.de). CS has different origins based on different concepts that date back until the mid-nineties, and we here refer to Riesch and Potter (2013) for a short review. We opted to follow the definition provided by the CS Central website operated by the Cornell University Ornithology Lab, which we feel comes closest to our perception of and needs from CS: CS is '*projects in which volunteers partner with scientists to answer real-world questions*' (Citizen Science Central 2017). We would, however, add that Citizen Scientists can very well gain extensive experience and expertise through training, participation and encouragement. In the field of biology, this could, for example, eventually lead to the training of parataxonomists and/or paraecologists, which has proven to be a highly productive approach from the social / cultural interaction all the way to a highly productive scientific level (Basset et al. 2000, Novotny et al. 2012).

However, of the data generated by the "usual" CS projects, only a few (12% out of 388 projects) are being published in peer-reviewed scientific articles (Theobald et al. 2015). This should be a strong incentive to create a platform that can connect professional scientists and citizen science in order to create more sustainable outcomes.

In a way, many taxonomists always were and still are highly advanced citizen scientists, i.e. extremely motivated amateurs educating themselves and often growing into world-leading authorities in their particular field. And recently, there has been increasing cooperation and exchange between such taxonomists and "professional" scientists (i.e. those whose job description includes taxonomy and systematics etc.). An example is DNA barcoding projects where museum scientists rely heavily on the expertise of amateur taxonomists who are often the only ones with knowledge of the taxonomy and ecology of certain taxa. Reassuringly, this has also led to co-authored publications (e.g. Rulik et al. (2017)). But these are experiments that were made in central Europe where communication among scientists and other stakeholders is usually well developed and access to taxonomic

knowledge is comparably easy due to the existence of significant historical library and collection resources.

However, most of the world's biodiversity is not in central Europe, but in tropical countries where it is not always easy, even for professional taxonomists, to access data and exchange ideas, let alone citizens access adequate resources.

At the same time, internet utilization is growing worldwide. Particularly in developing countries, in 2015 the adult internet user and mobile technology ownership reached 54% and 37% of the total population respectively and social networking usage is likely to be higher than in developed countries (Pousther 2016). Therefore, information accumulation and exchange around the globe becomes easier and faster. This new internet technology can be used by taxonomists and other interested citizens for educational and scientific purposes and this is the scope of the present study.

Here, we describe a simple approach (Fig. 1) to cooperate with a citizen scientist. In this case, in Bali, Indonesia, with the goal to conduct a sustainable, scientific experiment using (1) simple, existing technology and (2) enable this citizen scientist to actively participate in the experiment, at the same time (3) building capacity and (4) thus enable this citizen scientist to become part of an interactive scientific community and develop taxonomic skills. That citizen scientist is the tourist operator Suprayitno, the first author of this paper, who discovered his interest in entomology in 2016 as a simple pastime, being a fully independent and self-funded hobbyist. He established contact with the international entomological community via a Facebook group and thereby got attracted strongly to aquatic insects. Discussions and specimen identifications were made online on the social media site Facebook and via WhatsApp, which prove a powerful tool to exchange ideas and especially photographs of sufficient quality in order to help the citizen scientist to expand his taxonomic knowledge quickly. At the same time, discussion partners generated awareness of the CS that specimens and data should be stored in a sustainable manner, leading to the donation of his samples to the national depository of zoology, the Museum Zoologicum Bogoriense, which now houses the entire aquatic beetle collection from Bali. Thus, a pastime was strongly and quickly developed into a serious scientific activity with the aid of social media. This led to a CS project, to the development of taxonomic skills and to objective contributions to a large national museum collection.

This is the focus of our study. We demonstrate the feasibility of our approach by providing empirical data on the biogeography (faunistics) and taxonomy of selected Balinese aquatic Coleoptera because the fauna of Bali is comparably well known and the species selected for our study can be identified based on photographs taken with a handphone camera. The longer-term project goal is an extensive inventory of the Balinese fauna, for which we will propose a collaborative project in the future.

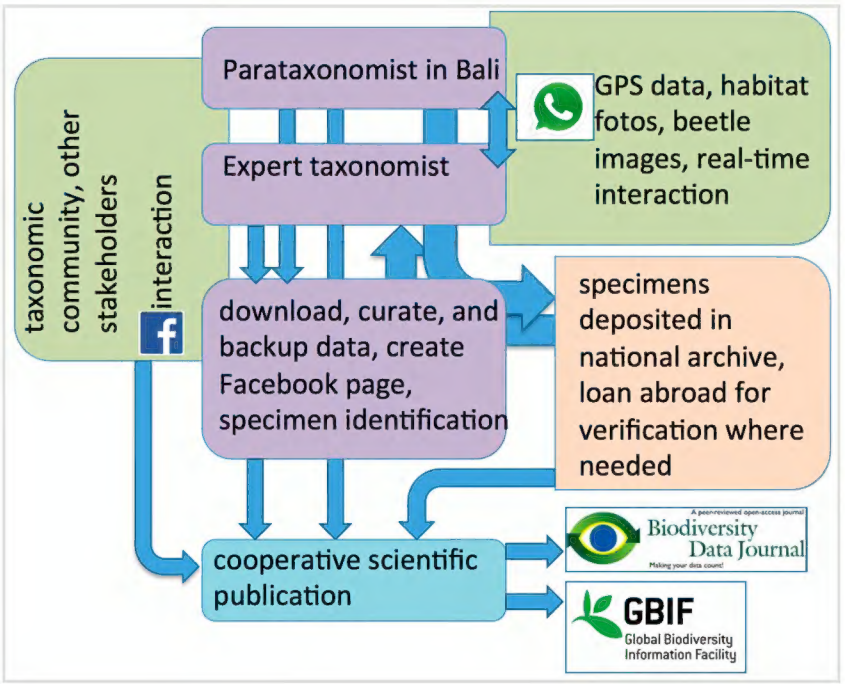
Parataxonomist in Bali
Expert taxonomist
GPS data, habitat fotos, beetle images, real-time interaction
taxonomic community, other stakeholders interaction
download, curate, and backup data, create Facebook page, specimen identification
specimens deposited in national archive, loan abroad for verification where needed
cooperative scientific publication
Biodiversity Data Journal
GBIF
Global Biodiversity Information Facility

Figure 1. doi

Workflow for this and especially future projects as proposed in this study.

Materials and methods

Hardware

We use an Indonesian made Polytron handphone 4G450. Habitat images were taken with the built-in camera (5MP, 2592 x 1944 pixels). The Geo-tagging function was used to map sampling localities in Google Maps.

For detailed photography of specimens, this camera was enhanced with clip-on magnification lenses according to beetle size, i.e. a 2.8X "macro lens" (article DCK004649) and a 20X "super macro/microscope lens" (article DCK004647) from dckina.com (obtained for approx. 12US$ each).

Workflow

The citizen scientist (in Fig. 1 referred to as parataxonomist) is in Bali and conducts fieldwork during his spare time. Specimens are stored in Ethanol and labeled according to locality, each with a unique collecting event identifier (e.g. BALI_NS_2016_09 which translates to ISLAND_COLLECTOR(NanoSuprayitno)_YEAR_LocalityNumber). These data are shared with collaborators by WhatsApp. Project partners translate the data into Darwin Core format for publication and GBIF upload. Photos of the sampling site and a Google Maps "dropped pin" URL with the GPS coordinates are sent via WhatsApp to a collaborator abroad as a backup and for further databasing. Digital images of beetles and habitats were also disseminated to a wider community of entomologists and other CS via a Facebook project page (https://www.facebook.com/Baliwaterbeetles/), and then species pages will be created for each species separately. In the course of this experiment, the CS was provided with a laptop to empower him to pursue the databasing work independently.

In general, some species can be identified based on photos. Merely using photographs, others can only be identified to genus, or species group. Many other species need to be examined by an expert and usually be dissected for proper identification. Thus, future investigation of the collected and documented specimens might be desirable. Our voucher specimens were, therefore, presented to a national repository, in this case the Indonesian Institute of Sciences, Zoological Museum: Museum Zoologicum Bogoriense (LIPI/MZB). From here, specimens can be shipped abroad as loans for taxonomic identification via standard inter-museum loan procedures.

The result of such a cooperative effort is scientific publications of new data gained as well as an improved national collection.

Data resources

Handphone digital imaging resources

Here, we provide the original images taken with a handphone camera and publicized via WhatsApp and Facebook as the starting point of the present project.

Allopachria quadripustulata (Fig. 2).

Figure 2. doi

Allopachria quadripustulata, HP image from BALI_NS_2016_09.

Cybister tripunctatus (Figs 3, 4)

Figure 3. doi

Dytiscidae image taken with handphone camera BALI_NS_2016_05 (large specimen: *Cybister tripunctatus temnenkii*; two smaller beetles above the *Cybister*: *Hydaticus fabricii*; four specimens on the left: *Hydaticus bipunctatus conjungens*).

Figure 4. doi

Cybister tripunctatus, HP image from Bali.

Eretes griseus (Figs 5, 6, 7, 8).

Figure 5. doi

Eretes griseus, HP image from BALI_NS_2016_19 (background: *Hydaticus bipunctatus conjungens*).

Figure 6. doi

Eretes griseus, HP image from BALI_NS_2016_34.

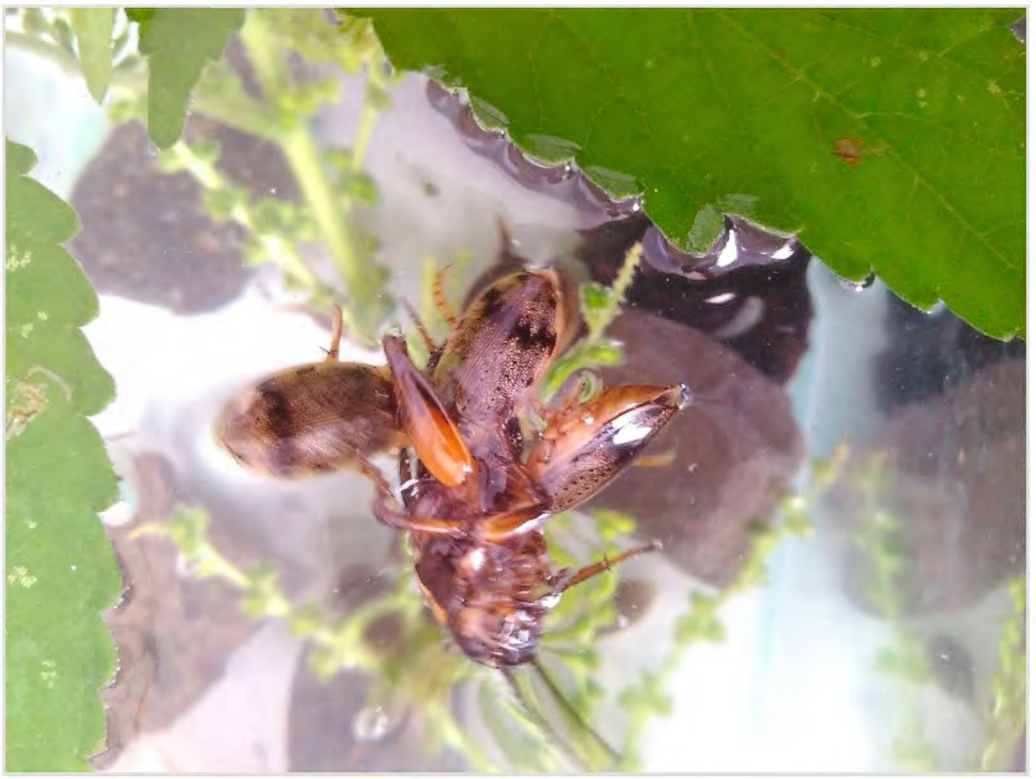

Figure 7. doi

Eretes griseus, HP image from Bali.

Figure 8. doi

Eretes griseus, foto of Balinese specimen kept in aquarium.

Hydaticus bipunctatus conjungens (Figs 3, 5).

Hydaticus fabricii (Fig. 3).

Hydaticus luczonicus (Fig. 9).

Figure 9. doi

Hydaticus luczonicus, HP image from BALI_NS_2016_16.

Hydaticus pacificus (Fig. 10).

Figure 10. doi

Hydaticus pacificus, HP image from BALI_NS_2016_17.

Microdytes elgae (Fig. 11).

Figure 11. doi

Microdytes elgae, HP image from BALI_NS_2016_07.

Sandracottus hunteri (Fig. 12).

Figure 12. doi

Sandracottus hunteri, HP image from BALI_NS_2016_18.

Taxon treatments

Allopachria quadripustulata Zimmermann, 1924

- Photos on Facebook Projectpage https://www.facebook.com/Baliwaterbeetles/posts/376240352500141
- Species-ID https://species-id.net/wiki/Allopachria_quadripustulata

Nomenclature

Zimmermann (1924): 195; Hendrich and Balke (1995): 41; Wewalka 2000: 101; Nilsson and Hájek 2017: 189.

Materials

a. scientificName: *Allopachria quadripustulata*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Manggis; verbatimElevation: 250m; locationRemarks: https://goo.gl/maps/rftZoZG1GGk; decimalLatitude: -8.484924; decimalLongitude: 115.528523; samplingProtocol: collected with strainer; eventDate: 2016-09-10; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_09; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

b. scientificName: *Allopachria quadripustulata*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; locality: Ubud, Monkey Forest; decimalLatitude: -8.517906; decimalLongitude: 115.258964; samplingProtocol: collected with strainer; individualCount: 22; lifeStage: adult; recordNumber: BA 07 (1990); recordedBy: Hendrich and Balke; institutionCode: ZSM etc; collectionCode: Entomology; ownerInstitutionCode: Zooligical State Collection Munich

c. scientificName: *Allopachria quadripustulata*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Bangli; locality: Ds. Penida Kelod - Tembuku, Tukad Cepung Waterfall; verbatimElevation: 700m; locationRemarks: https://goo.gl/maps/5zAgEyGmuSp; decimalLatitude: -8.4401039; decimalLongitude: 115.3847355; samplingProtocol: collected with strainer; eventDate: 2016-09-20; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_25; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

Distribution in Bali: See Fig. 13.

Geographic range outside Bali: Indonesia: Sumatra, Siberut, Bali, Flores.

Ecology

The species was collected from a shaded stream margin with volcanic gravel and roots, that site can be strongly flooded after rain (Hendrich & Balke 1995, Bali: Ubud, Monkey Forest, this site was revisited by Suprayitno several times but without beetle observations which might be due to heavy pollution of the stream). A similar habitat was now encountered in Manggis at locality BALI_NS_2016_09 (Fig. 14).

Figure 13. doi

Allopachria quadripustulata Distribution in Bali.

Figure 14. doi

Collecting site BALI_NS_2016_09.

Cybister tripunctatus temnenkii Aubé, 1838

- Photos on Facebook Projectpage https://www.facebook.com/Baliwaterbeetles/photos/a.360137520777091.1073741831.359144747543035/368971266560383/?type=3&theater

Nomenclature

Aubé (1838): 74; Hendrich and Balke 1995: 47; Nilsson and Hájek 2017: 77.

Materials

a. scientificName: *Cybister tripunctatus*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Cybister*; specificEpithet: *tripunctatus temnenkii*; scientificNameAuthorship: Aubé, 1838; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Buana Giri - Duda Timur; verbatimElevation: 530m; locationRemarks: https://goo.gl/maps/mjErpSjYjLF2; decimalLatitude: -8.450549; decimalLongitude: 115.495006; samplingProtocol: collected with strainer; eventDate: 08/30/2016; individualCount: 4; lifeStage: adult; recordNumber: BALI_NS_2016_05; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

b. scientificName: *Cybister tripunctatus*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Cybister*; specificEpithet: *tripunctatus temnenkii*; scientificNameAuthorship: Aubé, 1838; island: Bali; country: Indonesia; stateProvince: Bali; county: Gianyar; locality: Batubulan; verbatimElevation: 30m; locationRemarks: http://maps.google.com/?q=-8.623022,115.267418&hl=en&gl=us; decimalLatitude: -8.623022; decimalLongitude: 115.267418; samplingProtocol: collected with strainer; eventDate: 02/16/2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_22; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

c. scientificName: *Cybister tripunctatus*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Cybister*; specificEpithet: *tripunctatus temnenkii*; scientificNameAuthorship: Aubé, 1838; island: Bali; country: Indonesia; stateProvince: Bali; county: Gianyar; locality: Tirta, Empul; verbatimElevation: 400m; decimalLatitude: -8.415371; decimalLongitude: 115.314854; eventDate: 03/01/1986; individualCount: 1; lifeStage: adult; recordedBy: Hermmann; institutionCode: cAHerrmann; ownerInstitutionCode: Coll. A. Herrmann

d. scientificName: *Cybister tripunctatus*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Cybister*; specificEpithet: *tripunctatus temnenkii*; scientificNameAuthorship: Aubé, 1838; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Amed, Desa Bunutan; verbatimElevation: 10m; locationRemarks: https://goo.gl/maps/as6BWjA2qmq; decimalLatitude: -8.346592; decimalLongitude: 115.669913; samplingProtocol: collected with strainer; eventDate: 13.iv.2016 2016-04-13; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_26; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

e. scientificName: *Cybister tripunctatus*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Cybister*; specificEpithet: *tripunctatus temnenkii*; scientificNameAuthorship: Aubé, 1838; island: Bali; country: Indonesia; stateProvince: Bali; county: Denpasar; locality: Jl. Pantai Serangan, Serangan; verbatimElevation: 10m; locationRemarks: https://goo.gl/maps/5gZHFce9nGm; decimalLatitude: -8.732199; decimalLongitude: 115.235422; samplingProtocol: collected with strainer; eventDate: 03/17/2016; individualCount: 3; lifeStage: adult; recordNumber: BALI_NS_2016_33; recordedBy: Suprayitno;

institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

f. scientificName: *Cybister tripunctatus*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Cybister*; specificEpithet: *tripunctatus temnenkii*; scientificNameAuthorship: Aubé, 1838; island: Bali; country: Indonesia; stateProvince: Bali; county: Badung; locality: Sedang village, Abiansemal; verbatimElevation: 120m; locationRemarks: http://maps.google.com/?q=-8.564203,115.237549&hl=en&gl=us; decimalLatitude: -8.564203; decimalLongitude: 115.237549; samplingProtocol: collected with strainer; eventDate: 02/29/2016; individualCount: 5; lifeStage: adult; recordNumber: BALI_NS_2016_34; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

g. scientificName: *Cybister tripunctatus*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Cybister*; specificEpithet: *tripunctatus temnenkii*; scientificNameAuthorship: Aubé, 1838; island: Bali; country: Indonesia; stateProvince: Bali; county: Klungkung; locality: Jl. Ped - Buyuk, Nusa Penida; verbatimElevation: 10m; locationRemarks: https://goo.gl/maps/zSg3MYd4y5E2; decimalLatitude: -8.677565; decimalLongitude: 115.52212; samplingProtocol: collected with strainer; eventDate: 12/17/2016; individualCount: 2; lifeStage: adult; recordNumber: BALI_NS_2016_48; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

h. scientificName: *Cybister tripunctatus*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Cybister*; specificEpithet: *tripunctatus temnenkii*; scientificNameAuthorship: Aubé, 1838; island: Bali; country: Indonesia; stateProvince: Bali; locality: Lake Beratan; verbatimElevation: 1200m; decimalLatitude: -8.281779; decimalLongitude: 115.165512; samplingProtocol: observation at night; individualCount: >20; lifeStage: adult; recordedBy: Lars Hendrich observation

i. scientificName: *Cybister tripunctatus*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Cybister*; specificEpithet: *tripunctatus temnenkii*; scientificNameAuthorship: Aubé, 1838; island: Bali; country: Indonesia; stateProvince: Bali; locality: Lake Tamblingan; decimalLatitude: -8.264136; decimalLongitude: 115.097851; samplingProtocol: observation at day; eventDate: 2009; lifeStage: adult; recordedBy: Michael Balke & Ditta Amran

Distribution in Bali: See Fig. 15.

Geographic range outside Bali: The species is widespread in the Australian, Oriental and Palearctic regions; the nominal subspecies is Afrotropical.

Ecology

In a wide variety of stagnant water habitats such as lakes, ponds, paddies, where there is sufficient vegetation. Also in slowly streaming wide rivers with quieter, shallow and vegetated sections.

Figure 15. doi

Cybister tripunctatus temnenkii Distribution in Bali.

Eretes griseus (Fabricius, 1781)

- Video on Facebook https://www.facebook.com/Baliwaterbeetles/videos/552907661500075/

Nomenclature

Fabricius 1781: 293; Miller 2002: 262; Nilsson and Hájek 2017: 89.

Materials

a. scientificName: *Eretes griseus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Klungkung; locality: Jl. Raya Aan - Banjar Rangkan; verbatimElevation: 200m; locationRemarks: http://maps.google.com/?q=-8.514642,115.379928&hl=en&gl=us; decimalLatitude: -8.514642; decimalLongitude: 115.379928; samplingProtocol: collected with strainer; eventDate: 2016-08-25; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_19; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

b. scientificName: *Eretes griseus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Amed, Desa Bunutan; verbatimElevation: 10m; locationRemarks: https://goo.gl/maps/as6BWjA2qmq; decimalLatitude: -8.346592; decimalLongitude: 115.669913; samplingProtocol: collected with strainer; eventDate: 2016-04-13; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_26; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

c. scientificName: *Eretes griseus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Denpasar; locality: Jl. Pantai Serangan, Serangan; verbatimElevation: 10m; locationRemarks: https://goo.gl/maps/5gZHFce9nGm; decimalLatitude: -8.732199; decimalLongitude: 115.235422;

samplingProtocol: collected with strainer; eventDate: 2016-03-07; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_33; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

d. scientificName: *Eretes griseus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Klungkung; locality: Tukad Yeh Unda River; verbatimElevation: 6m; locationRemarks: https://goo.gl/maps/fxseqTb5b6N2; decimalLatitude: -8.561778; decimalLongitude: 115.43021; samplingProtocol: collected with strainer; eventDate: 2016-02-05; individualCount: 9; lifeStage: adult; recordNumber: BALI_NS_2016_37; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

e. scientificName: *Eretes griseus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Badung; locality: Sedang village, Abiansemal; verbatimElevation: 120m; locationRemarks: http://maps.google.com/?q=-8.564203,115.237549&hl=en&gl=us; decimalLatitude: -8.564203; decimalLongitude: 115.237549; samplingProtocol: collected with strainer; eventDate: 2016-02-29; individualCount: 24; lifeStage: adult; recordNumber: BALI_NS_2016_34; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

f. scientificName: *Eretes griseus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Klungkung; locality: Jl. Ped - Buyuk, Nusa Penida; verbatimElevation: 10m; locationRemarks: https://goo.gl/maps/zSg3MYd4y5E2; decimalLatitude: -8.677565; decimalLongitude: 115.52212; samplingProtocol: collected with strainer; eventDate: 2016-12-17; individualCount: 5; lifeStage: adult; recordNumber: BALI_NS_2016_48; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

g. scientificName: *Eretes griseus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Karangasem - Seraya; verbatimElevation: 10m; locationRemarks: https://goo.gl/maps/z4xE7VS3xfE2; decimalLatitude: -8.367711; decimalLongitude: 115.701407; samplingProtocol: collected with strainer; eventDate: 2017-02-18; individualCount: 5; lifeStage: adult; recordNumber: BALI_NS_2017_59; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

Distribution in Bali: See Fig. 16.

Geographic range outside Bali: Widespread throughout warm regions of the Old World. First record for Bali.

Ecology: This seems to be a supertramp species, i.e. an early colonizer of stagnant, fully sun-exposed habitats on raw soil, with fine sand / clay. The beetles seem to dig into the substrate for cover. Often found at light (Fig. 17).

Figure 16. doi

Eretes griseus Distribution in Bali.

Figure 17. doi

Collecting site BALI_NS_2016_34.

Hydaticus bipunctatus conjungens Régimbart, 1899

Nomenclature

Régimbart 1899: 329; Hendrich and Balke 1995: 46; Nilsson and Hájek 2017: 91.

Materials

a. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Gegelang - Duda Timur; verbatimElevation: 460m; locationRemarks: https://goo.gl/maps/ti5uRJuMQYu; decimalLatitude: -8.469917; decimalLongitude: 115.487944; samplingProtocol: collected with strainer; eventDate: 08/30/2016; individualCount: 2; lifeStage: adult; recordNumber: BALI_NS_2016_04; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

b. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Buana Giri - Duda Timur; verbatimElevation: 530m; locationRemarks: https://goo.gl/maps/mjErpSjYjLF2; decimalLatitude: -8.450549; decimalLongitude: 115.495006; samplingProtocol: collected with strainer; eventDate: 08/30/2016; individualCount: 4; lifeStage: adult; recordNumber: BALI_NS_2016_05; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

c. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Pura Pucak Kaler; verbatimElevation: 60m; locationRemarks: https://goo.gl/maps/LsgLwZ8kgPk; decimalLatitude: -8.501913; decimalLongitude: 115.483401; samplingProtocol: collected with strainer; eventDate: 09/01/2016; individualCount: 6; lifeStage: adult; recordNumber: BALI_NS_2016_06; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

d. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Tabanan; locality: Baturiti; verbatimElevation: 830m; locationRemarks: https://goo.gl/maps/WWGpxwqfgFm; decimalLatitude: -8.325723; decimalLongitude: 115.195042; samplingProtocol: collected with strainer; eventDate: 09/24/2016; individualCount: 2; lifeStage: adult; recordNumber: BALI_NS_2016_12; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

e. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya (2); verbatimElevation: 270m; locationRemarks: https://goo.gl/maps/MRMj83F9AAz; decimalLatitude: -8.421717; decimalLongitude: 115.669085; samplingProtocol: collected

with strainer; eventDate: 06/04/2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_18; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

f. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya (3); verbatimElevation: 270m; locationRemarks: https://goo.gl/maps/GJpzEosySy12; decimalLatitude: -8.421574; decimalLongitude: 115.671857; samplingProtocol: collected with strainer; eventDate: 06/05/2016; individualCount: 3; lifeStage: adult; recordNumber: BALI_NS_2016_19; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

g. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya (5); verbatimElevation: 170m; locationRemarks: https://goo.gl/maps/fAT8hjLK4Y82; decimalLatitude: -8.417738; decimalLongitude: 115.688551; samplingProtocol: collected with strainer; eventDate: 06/16/2016; individualCount: 5; lifeStage: adult; recordNumber: BALI_NS_2016_20; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

h. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Badung; locality: Desa Ungasan near Pecatu; verbatimElevation: 140m; locationRemarks: https://goo.gl/maps/p64cgybQRDF2; decimalLatitude: -8.840126; decimalLongitude: 115.144003; samplingProtocol: collected with strainer; eventDate: 06/20/2016; individualCount: 2; lifeStage: adult; recordNumber: BALI_NS_2016_23; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

i. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Amed, Desa Bunutan; verbatimElevation: 10m; locationRemarks: https://goo.gl/maps/as6BWjA2qmq; decimalLatitude: -8.346592; decimalLongitude: 115.669913; samplingProtocol: collected with strainer; eventDate: 04/13/2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_26; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

j. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Gianyar; locality: Jl. Katiklantang, Ds. Singakerta, Ubud; verbatimElevation: 190m; locationRemarks: https://goo.gl/maps/tcZcCJwQrzT2; decimalLatitude: -8.517321; decimalLongitude: 115.251018; samplingProtocol: collected with strainer; eventDate: 07/06/2016; individualCount: 3; lifeStage: adult; recordNumber: BALI_NS_2016_31; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

k. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*;

scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Denpasar; locality: Jl. Pantai Serangan, Serangan; verbatimElevation: 10m; locationRemarks: https://goo.gl/maps/5gZHFce9nGm; decimalLatitude: -8.732199; decimalLongitude: 115.235422; samplingProtocol: collected with strainer; eventDate: 03/07/2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_33; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

l. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Raya Yehpoh - Manggis; verbatimElevation: 50m; locationRemarks: http://maps.google.com/?q=-8.486125,115.516439&hl=en&gl=us; decimalLatitude: -8.486125; decimalLongitude: 115.516439; samplingProtocol: collected with strainer; eventDate: 11/05/2016; individualCount: 5; lifeStage: adult; recordNumber: BALI_NS_2016_39; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

m. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Gianyar; locality: Jl. Yudistira - Batubulan; verbatimElevation: 40m; locationRemarks: https://goo.gl/maps/sQHVTyGEDkA2; decimalLatitude: -8.624977; decimalLongitude: 115.276241; samplingProtocol: collected with strainer; eventDate: 12/31/2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_51; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

n. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Bangli; locality: Central Batur - Kintamani; verbatimElevation: 1000m; locationRemarks: https://goo.gl/maps/btGBsiLJjxm; decimalLatitude: -8.266562; decimalLongitude: 115.381414; samplingProtocol: collected with strainer; eventDate: 01/08/2017; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2017_54; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

o. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Karangasem - Seraya; verbatimElevation: 10m; locationRemarks: https://goo.gl/maps/z4xE7VS3xfE2; decimalLatitude: -8.367711; decimalLongitude: 115.701407; samplingProtocol: collected with strainer; eventDate: 02/18/2017; individualCount: 3; lifeStage: adult; recordNumber: BALI_NS_2017_59; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

p. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Unname road - Bunutan - Abang; verbatimElevation: 100m; locationRemarks: https://goo.gl/maps/SPcH1zJWEVD2; decimalLatitude: -8.359665; decimalLongitude: 115.66442; samplingProtocol: collected

with strainer; eventDate: 02/19/2017; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2017_60; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

q. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Unnamed road - Bunutan - Abang; verbatimElevation: 100m; locationRemarks: https://goo.gl/maps/Efa9yguQBB32; decimalLatitude: -8.360504; decimalLongitude: 115.662144; samplingProtocol: collected with strainer; eventDate: 04/14/2016; individualCount: 5; lifeStage: adult; recordNumber: BALI_NS_2016_61; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

r. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Klungkung; locality: Desa Selat, Klungkung, Alam rafting finish point river; verbatimElevation: 240m; locationRemarks: http://maps.google.com/?q=-8.478910,115.410956&hl=en&gl=us; decimalLatitude: -8.47891; decimalLongitude: 115.410956; samplingProtocol: collected with strainer; eventDate: 04/13/2017; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2017_62; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

s. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Melasti, Purwakerti, Abang; verbatimElevation: 50m; locationRemarks: https://goo.gl/maps/MaPhfyqF8Du; decimalLatitude: -8.330304; decimalLongitude: 115.637501; samplingProtocol: collected with strainer; eventDate: 04/11/2017; individualCount: 2; lifeStage: adult; recordNumber: BALI_NS_2017_63; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

t. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Gianyar; locality: Ubud; verbatimElevation: 180m; decimalLatitude: -8.516324; decimalLongitude: 115.257336; samplingProtocol: collected with strainer; eventDate: 10/27/1993; individualCount: 1; lifeStage: adult; recordNumber: BA93-2; recordedBy: Balke; institutionCode: ZSM; collectionCode: Entomology; ownerInstitutionCode: Zooligical State Collection Munich

u. scientificName: *Hydaticus bipuncatatus conjungens*; class: Insecta; order: Coleoptera; family: Dytiscidae; genus: *Hydaticus*; specificEpithet: *Hydaticus bipuncatatus conjungens*; scientificNameAuthorship: Régimbart, 1899; island: Bali; country: Indonesia; stateProvince: Bali; county: Buleleng; locality: Lake Buyan; verbatimElevation: 1250m; decimalLatitude: -8.251232; decimalLongitude: 115.129773; samplingProtocol: dipnet; eventDate: 07/12/1991; individualCount: 40; lifeStage: adult; recordNumber: BA9; recordedBy: Hendrich & Balke; institutionCode: ZSM; collectionCode: Entomology; ownerInstitutionCode: Zooligical State Collection Munich

Distribution in Bali: See Fig. 18.

Figure 18. doi

Hydaticus bipunctatus conjungens Distribution in Bali.

Geographic range outside Bali: Sunda islands as far east as Sumba, Sulawesi.

Ecology

The species is occupies stagnant water habitats with emergent vegetation or pools on rocky / gravelly ground at the edge of streams and creeks, sometimes also roadside pools (Figs 19, 20).

Figure 19. doi

Collecting site BALI_NS_2016_60.

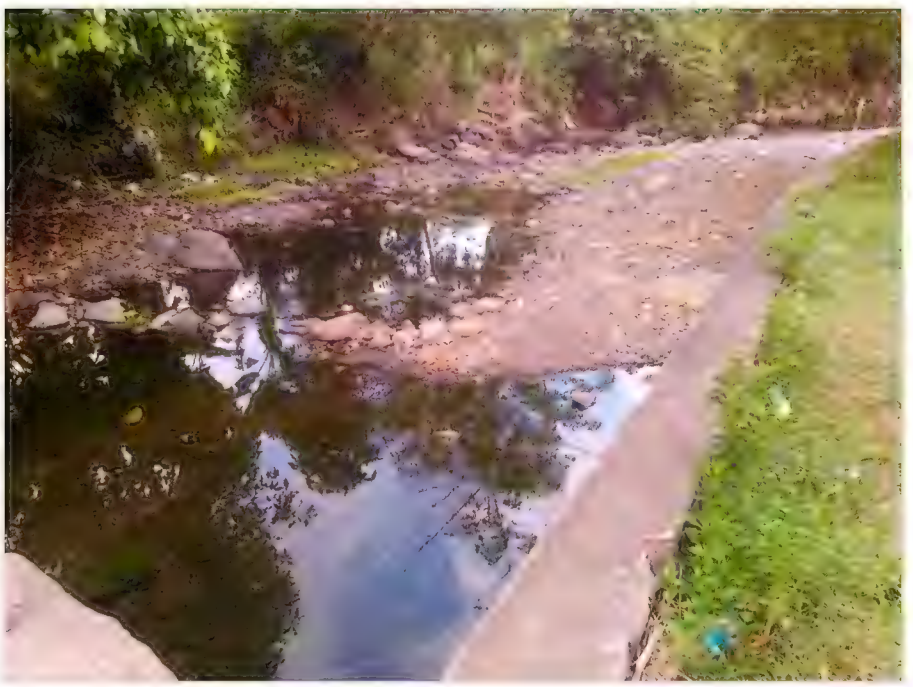

Figure 20. doi

Collecting site BALI_NS_2016_39.

Hydaticus fabricii (W.S. Macleay, 1825)

- Water beetle of Bali Project on Facebook https://www.facebook.com/Baliwaterbeetles/photos/a.360137520777091.1073741831.359144747543035/442314512559391/?type=3&theater

Nomenclature

Wewalka 1979: 121;Hendrich and Balke 1995: 46; Nilsson and Hájek 2017: 92.

Materials

a. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Gegelang - Duda Timur; verbatimElevation: 460m; locationRemarks: https://goo.gl/maps/ti5uRJuMQYu; decimalLatitude: -8.469917; decimalLongitude: 115.487944; samplingProtocol: collected with strainer; samplingEffort: 2016-08-30; eventDate: 30.viii.2016; individualCount: 2; lifeStage: adult; recordNumber: BALI_NS_2016_04; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

b. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Buana Giri - Duda Timur; verbatimElevation: 530m; locationRemarks: https://goo.gl/maps/mjErpSjYjLF2; decimalLatitude: -8.450549; decimalLongitude: 115.495006; samplingProtocol: collected with strainer; samplingEffort: 2016-08-30; eventDate: 30.viii.2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_05; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

c. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Pura

Pucak Kaler; verbatimElevation: 60m; locationRemarks: https://goo.gl/maps/LsgLwZ8kgPk; decimalLatitude: -8.501913; decimalLongitude: 115.483401; samplingProtocol: collected with strainer; samplingEffort: 2016-09-01; eventDate: 1.ix.2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_06; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

d. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Tabanan; locality: Baturiti; verbatimElevation: 830m; locationRemarks: https://goo.gl/maps/WWGpxwqfgFm; decimalLatitude: -8.325723; decimalLongitude: 115.195042; samplingProtocol: collected with strainer; samplingEffort: 2016-09-24; eventDate: 24.ix.2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_12; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

e. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Klungkung; locality: Jl. Raya Aan - Banjar Rangkan; verbatimElevation: 200m; locationRemarks: http://maps.google.com/?q=-8.514642,115.379928&hl=en&gl=us; decimalLatitude: -8.514642; decimalLongitude: 115.379928; samplingProtocol: collected with strainer; samplingEffort: 2016-08-25; eventDate: 25.viii.2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_01; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

f. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Manggis; verbatimElevation: 40m; locationRemarks: https://goo.gl/maps/rftZoZG1GGk; decimalLatitude: -8.484924; decimalLongitude: 115.528523; samplingProtocol: collected with strainer; samplingEffort: 2016-09-10; eventDate: 10.ix.2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_09; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

g. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya (5); verbatimElevation: 170m; locationRemarks: https://goo.gl/maps/fAT8hjLK4Y82; decimalLatitude: -8.417738; decimalLongitude: 115.688551; samplingProtocol: collected with strainer; samplingEffort: 2016-06-16; eventDate: 16.vi.2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_20; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

h. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Gianyar; locality: Batubulan; verbatimElevation: 30m; locationRemarks: http://maps.google.com/?q=-8.623022,115.267418&hl=en&gl=us; decimalLatitude: -8.623022; decimalLongitude: 115.267418; samplingProtocol: collected with strainer; samplingEffort: 2016-02-16; eventDate: 16.ii.2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_22; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

i. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Badung; locality: Jl.Tambakbayuh, Ds. Pererenan, Mengwi; verbatimElevation: 30m; locationRemarks: https://goo.gl/maps/nrVaj1pcQ5P2; decimalLatitude: -8.626453; decimalLongitude:

115.135793; samplingProtocol: collected with strainer; samplingEffort: 2016-07-22; eventDate: 22.vii.2016; individualCount: 3; lifeStage: adult; recordNumber: BALI_NS_2016_27; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

j. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Gianyar; locality: Jl. Katiklantang, Ds. Singakerta, Ubud; verbatimElevation: 190m; locationRemarks: https://goo.gl/maps/tcZcCJwQrzT2; decimalLatitude: -8.517321; decimalLongitude: 115.251018; samplingProtocol: collected with strainer; samplingEffort: 2016-07-06; eventDate: 6.vii.2016; individualCount: 4; lifeStage: adult; recordNumber: BALI_NS_2016_31; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

k. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Badung; locality: Sedang village, Abiansemal; verbatimElevation: 120m; locationRemarks: http://maps.google.com/?q=-8.564203,115.237549&hl=en&gl=us; decimalLatitude: -8.564203; decimalLongitude: 115.237549; samplingProtocol: collected with strainer; samplingEffort: 2016-02-29; eventDate: 29.ii.2016; individualCount: 5; lifeStage: adult; recordNumber: BALI_NS_2016_34; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

l. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Klungkung; locality: Tukad Yeh Unda River; verbatimElevation: 6m; locationRemarks: https://goo.gl/maps/fxseqTb5b6N2; decimalLatitude: -8.561778; decimalLongitude: 115.43021; samplingProtocol: collected with strainer; samplingEffort: 2016-02-05; eventDate: 5.ii.2016; individualCount: 18; lifeStage: adult; recordNumber: BALI_NS_2016_37; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

m. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jl. Raya Yehpoh - Manggis; verbatimElevation: 50m; locationRemarks: http://maps.google.com/?q=-8.486125,115.516439&hl=en&gl=us; decimalLatitude: -8.486125; decimalLongitude: 115.516439; samplingProtocol: collected with strainer; samplingEffort: 2016-11-05; eventDate: 5.xi.2016; individualCount: 2; lifeStage: adult; recordNumber: BALI_NS_2016_39; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

n. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Gianyar; locality: Jl. Yudistira - Batubulan; verbatimElevation: 40m; locationRemarks: https://goo.gl/maps/sQHVTyGEDkA2; decimalLatitude: -8.624977; decimalLongitude: 115.276241; samplingProtocol: collected with strainer; samplingEffort: 2016-12-31; eventDate: 31.xii.2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_51; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

o. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Gianyar; locality: Jl. Katiklantang - Desa Singakerta - Ubud; verbatimElevation: 200m; locationRemarks: https://goo.gl/maps/jpGV7BM7ixN2; decimalLatitude: -8.515147; decimalLongitude: 115.248926; samplingProtocol: collected with strainer; samplingEffort: 2017-01-20; eventDate: 20.i.2017; individualCount: 2; lifeStage: adult; recordNumber:

BALI_NS_2017_55; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

p. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Unnamed road - Bunutan - Abang; verbatimElevation: 100m; locationRemarks: https://goo.gl/maps/Efa9yguQBB32; decimalLatitude: -8.360504; decimalLongitude: 115.662144; samplingProtocol: collected with strainer; samplingEffort: 2016-04-14; eventDate: 14.iv.2016; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_61; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

q. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Klungkung; locality: Desa Selat, Klungkung, Alam rafting finish point river; verbatimElevation: 240m; locationRemarks: http://maps.google.com/?q=-8.478910,115.410956&hl=en&gl=us; decimalLatitude: -8.47891; decimalLongitude: 115.410956; samplingProtocol: collected with strainer; samplingEffort: 2017-04-13; eventDate: 13.iv.2017; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2017_62; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

r. scientificName: *Hydaticus fabricii*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Gianyar; locality: Ubud; verbatimElevation: 180m; decimalLatitude: -8.516324; decimalLongitude: 115.257336; samplingProtocol: collected with strainer; samplingEffort: 1990-08-26; eventDate: 26.viii.1990; individualCount: 4; lifeStage: adult; recordNumber: BA3; recordedBy: Hendrich and Balke; institutionCode: ZSM etc; collectionCode: Entomology; ownerInstitutionCode: Zooligical State Collection Munich

Distribution in Bali: See Fig. 21.

Figure 21. doi

Hydaticus fabriciii Distribution in Bali.

Geographic range outside Bali: India, SE Asia, Sunda islands as far east as Sumba (Wewalka 1979).

Ecology

The species is an inhabitatnt of stagnant water habitats, often in rice paddies (Fig. 22).

Figure 22. doi

Collecting site BALI_NS_2016_55.

Hydaticus luczonicus Aubé, 1838

Nomenclature

Aubé 1838: 179; Vazirani 1969: 262; Nilsson and Hájek 2017: 93.

Material

a. scientificName: *Hydaticus luczonicus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya (2); verbatimElevation: 270m; locationRemarks: https://goo.gl/maps/MRMj83F9AAz; decimalLatitude: -8.421717; decimalLongitude: 115.669085; samplingProtocol: collected with strainer; eventDate: 4.vi.2016-06-04; individualCount: 2; recordNumber: BALI_NS_2016_18; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

Distribution in Bali: See Fig. 23.

Figure 23. doi

Hydaticus luczonicus Distribution in Bali.

Geographic range outside Bali: Philippines, SE Asia. First record for Bali.

Ecology

The species occupies stagnant water habitats. In Bali, it was collected in rest pools in a streambed on volcanic rock (Fig. 24).

Figure 24. doi

Collecting site BALI_NS_2016_18.

Hydaticus pacificus Aubé, 1838

- Photos on Facebook Projectpage https://www.facebook.com/Baliwaterbeetles/photos/a.363732503750926.1073741835.359144747543035/363733343750842/?type=3&theater

Nomenclature

Aubé 1838: 177; Wewalka 2016: 11; Nilsson and Hájek 2017: 94.

Materials

a. scientificName: *Hydaticus pacificus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya; verbatimElevation: 350m; locationRemarks: https://goo.gl/maps/ftkQnXGqTjC2; decimalLatitude: -8.410798; decimalLongitude: 115.6815772; samplingProtocol: collected with strainer; eventDate: 2016-06-15; individualCount: 2; lifeStage: adult; recordNumber: BALI_NS_2016_16; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

b. scientificName: *Hydaticus pacificus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya; verbatimElevation: 250m; locationRemarks: https://goo.gl/maps/vp4fVVnqXsy; decimalLatitude: -8.426531; decimalLongitude: 115.661005; samplingProtocol: collected with strainer; eventDate: 2016-06-02; individualCount: 4; lifeStage: adult; recordNumber: BALI_NS_2016_17; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

c. scientificName: *Hydaticus pacificus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya; verbatimElevation: 270m; locationRemarks: https://goo.gl/maps/MRMj83F9AAz; decimalLatitude: -8.421717; decimalLongitude: 115.669085; samplingProtocol: collected with strainer; eventDate: 2016-06-04; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_18; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

d. scientificName: *Hydaticus pacificus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya; verbatimElevation: 270m; locationRemarks: https://goo.gl/maps/GJpzEosySy12; decimalLatitude: -8.421574; decimalLongitude: 115.671857; samplingProtocol: collected with strainer; eventDate: 2016-06-05; individualCount: 3; lifeStage: adult; recordNumber: BALI_NS_2016_19; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

e. scientificName: *Hydaticus pacificus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya; verbatimElevation: 170m; locationRemarks: https://goo.gl/maps/fAT8hjLK4Y82; decimalLatitude: -8.417738; decimalLongitude: 115.688551; samplingProtocol: collected with strainer; eventDate: 2016-06-16; individualCount: 28; lifeStage: adult; recordNumber: BALI_NS_2016_20; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

f. scientificName: *Hydaticus pacificus*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Badung; locality: Desa Ungasan near Pecatu; verbatimElevation: 140m; locationRemarks: https://goo.gl/maps/p64cgybQRDF2; decimalLatitude: -8.840126; decimalLongitude: 115.144003; samplingProtocol: collected with strainer; eventDate: 2016-06-20; individualCount: 2; lifeStage: adult; recordNumber: BALI_NS_2016_23; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

Distribution in Bali: See Fig. 25.

Figure 25. doi

Hydaticus pacificus Distribution in Bali.

Geographic range outside Bali: SE Asia, Sunda islands as far east as Tanimbar; not on Borneo or Sulawesi. This species was first recorded for Bali by Wewalka (2016) based on photography we presented on FaceBook.

Ecology

The species occupies stagnant water bodies. In Bali, it was often found in pools of intermittent streams (Figs 26, 27, 28, 29).

Figure 26. doi

Collecting site BALI_NS_2016_17.

Figure 27. doi

Collecting site BALI_NS_2016_17.

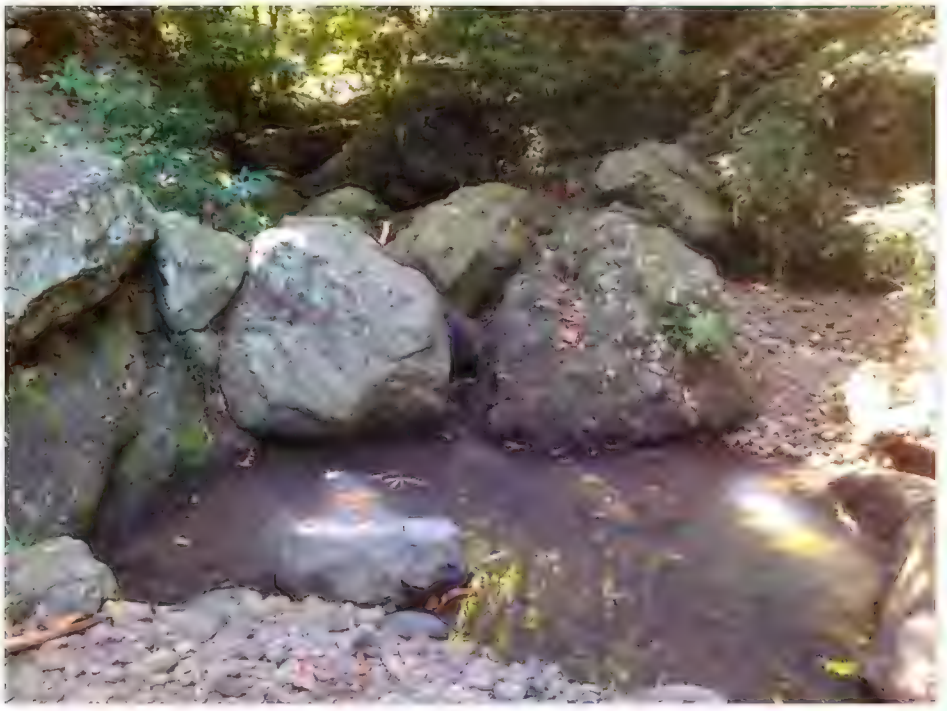

Figure 28. doi

Collecting site BALI_NS_2016_19.

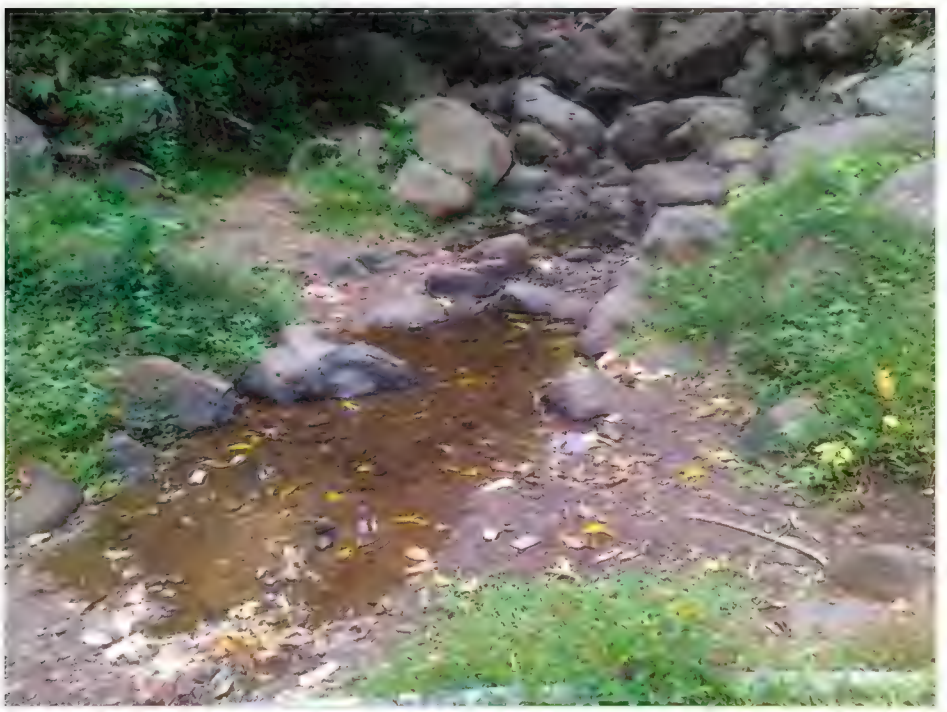

Figure 29. doi

Collecting site BALI_NS_2016_16.

Microdytes elgae Hendrich, Balke & Wewalka, 1995

Nomenclature

Hendrich and Balke 1995: 42; Aubé 1838: 177; Nilsson and Hájek 2017: 202.

Materials

a. scientificName: *Microdytes elgae*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Tabanan; locality: Jl. Raya Apuan Senganan - Baturiti; verbatimElevation: 600m; locationRemarks: https://goo.gl/maps/DwRBDdgGPwp; decimalLatitude: -8.362083; decimalLongitude: 115.180111; samplingProtocol: collected with strainer; eventDate: 2016-09-04; individualCount: 7; lifeStage: adult; recordNumber: BALI_NS_2016_07; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

b. scientificName: *Microdytes elgae*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Buleleng; locality: Ds. Selat, Sukasada; verbatimElevation: 180m; locationRemarks: https://goo.gl/maps/DVC4v6KZQ2R2; decimalLatitude: -8.174688; decimalLongitude: 115.066921; samplingProtocol: collected with strainer; eventDate: 2016-05-31; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_35; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

c. scientificName: *Microdytes elgae*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Tabanan; locality: Jl. Bantas - Pajahan - Pupuan; verbatimElevation: 500m; locationRemarks: https://goo.gl/maps/2JtWBirCLHR2; decimalLatitude: -8.345852; decimalLongitude: 114.994454; samplingProtocol: collected with strainer; eventDate: 2017-01-26; individualCount: 22; lifeStage: adult; recordNumber: BALI_NS_2017_56; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

d. scientificName: *Microdytes elgae*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; locality: Bedugul, Candi Kuning; verbatimElevation: 1320m; decimalLatitude: -8.253661; decimalLongitude: 115.173608; samplingProtocol: collected with strainer; eventDate: 1990-08-27 and 1991-07-11; individualCount: 2; lifeStage: adult; recordNumber: BA5; recordedBy: Hendrich & Balke; institutionCode: ZSM etc; collectionCode: Entomology; datasetName: Zooligical State Collection Munich; ownerInstitutionCode: Zooligical State Collection Munich; basisOfRecord: Entomology; informationWithheld: Zooligical State Collection Munich

Distribution in Bali: See Fig. 30.

Geographic range outside Bali: Widespread through the SE Paleartic region and SE Asia (Bhutan, Indonesia [Bali, Lombok, Kalimantan], Malaysia [Peninsula, Sarawak], Singapore) (Balke et al. 1999, Hendrich et al. 2004).

Ecology

Microdytes elgae inhabits small shaded or semishaded helocrenes as well as small streams in shaded forest environments. The beetles usually hide beneath leaves and in the gravel under only a very thin film of water (Hendrich et al. 2004) (Figs 31, 32).

Figure 30. doi

Microdytes elgae Distribution in Bali.

Figure 31. doi

Collecting site BALI_NS_2016_56.

Figure 32. doi

Collecting site BALI_NS_2016_56.

Sandracottus hunteri (Crotch, 1872)

- Photos on Facebook Projectpage https://www.facebook.com/Baliwaterbeetles/photos/a.363732503750926.1073741835.359144747543035/363732707084239/?type=3&theater

Nomenclature

Crotch 1872: 205; Hendrich and Balke 1995: 47; Nilsson and Hájek 2017: 85.

Note, this species was to date treated under the name *S. mixtus* (Blanchard, 1843). However, this name is not applicable to the species treated here, with the available name being *Hydaticus hunteri* Crotch, 1872 (a taxonomic clarification will be presented by Hendrich, in prep.).

Materials

a. scientificName: *Sandracottus hunteri*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya (4); verbatimElevation: 300m; locationRemarks: https://goo.gl/maps/ftkQnXGqTjC2; decimalLatitude: -8.410798; decimalLongitude: 115.6815772; samplingProtocol: collected with strainer; eventDate: 2016-08-21; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_16; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

b. scientificName: *Sandracottus hunteri*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya (1); verbatimElevation: 250m; locationRemarks: https://goo.gl/maps/vp4fVVnqXsy; decimalLatitude: -8.426531; decimalLongitude: 115.661005; samplingProtocol: collected with strainer; eventDate: 2016-07-02; individualCount: 1; lifeStage: adult; recordNumber: BALI_NS_2016_17; recordedBy: Suprayitno;

institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

c. scientificName: *Sandracottus hunteri*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Karangasem; locality: Jalan Karangasem - Seraya (3); verbatimElevation: 260m; locationRemarks: https://goo.gl/maps/GJpzEosySy12; decimalLatitude: -8.421574; decimalLongitude: 115.671857; samplingProtocol: collected with strainer; eventDate: 2016-07-05; individualCount: 2; lifeStage: adult; recordNumber: BALI_NS_2016_19; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

d. scientificName: *Sandracottus hunteri*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; county: Badung; locality: Desa Ungasan near Pecatu; verbatimElevation: 140m; locationRemarks: https://goo.gl/maps/p64cgybQRDF2; decimalLatitude: -8.840126; decimalLongitude: 115.144003; samplingProtocol: collected with strainer; eventDate: 2016-06-20; individualCount: 2; lifeStage: adult; recordNumber: BALI_NS_2016_23; recordedBy: Suprayitno; institutionCode: MZB; collectionCode: Entomology; ownerInstitutionCode: Museum Zoologicum Bogoriense

e. scientificName: *Sandracottus hunteri*; class: Insecta; order: Coleoptera; family: Dytiscidae; island: Bali; country: Indonesia; stateProvince: Bali; locality: Bedugul, Candi Kuning; verbatimElevation: 1320m; decimalLatitude: -8.253661; decimalLongitude: 115.173608; samplingProtocol: dipnet; eventDate: 1991-07-11; individualCount: 1; lifeStage: adult; recordNumber: BA8; recordedBy: Hendrich & Balke; institutionCode: ZSM etc; collectionCode: Entomology; datasetName: Zooligical State Collection Munich; ownerInstitutionCode: Zooligical State Collection Munich; basisOfRecord: Entomology; informationWithheld: Zooligical State Collection Munich

Distribution in Bali: See Fig. 33.

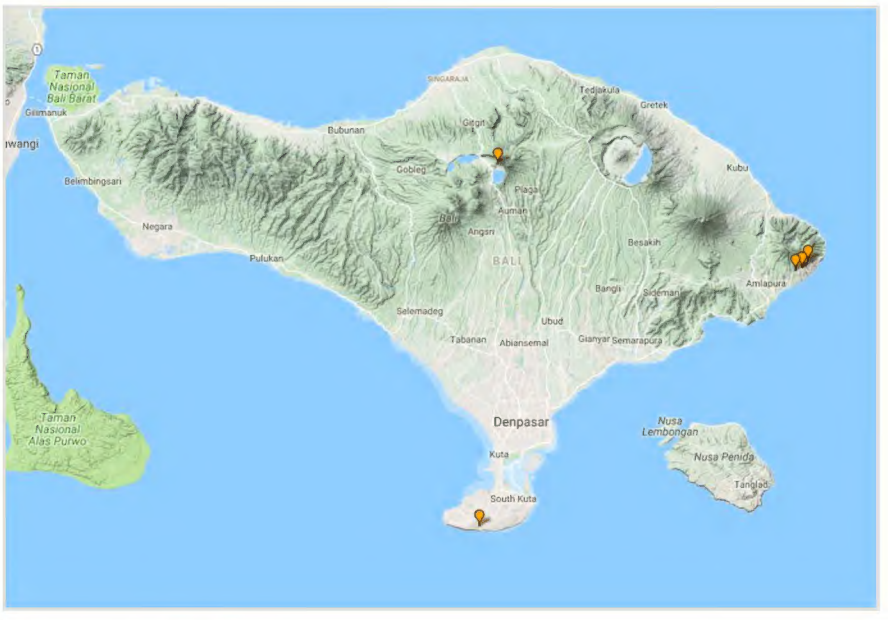

Figure 33. doi

Sandracottus hunteri Distribution in Bali.

Geographic range outside Bali: Oriental Region.

Ecology: Pools in intermittend streams (Figs 26, 28, 29).

Discussion

The workflow described here has proven useful to connect a highly motivated citizen scientist to expert taxonomists and museum curators. Online information exchange and training is leading to the formation of a parataxonomist, and has led to the enhancement of a national depository. We suggest that this approach would also be very beneficial for researchers at universities in less connected areas, such as ecologists and zoologists, who are frequently confronted with the need to identify species in the course of their work, but are often essentially operating at the same level of taxonomic expertise as an interested amateur. In addition to enabling these researchers to publish higher quality papers, the formation of links to national depositories would add sustainability to biodiversity research where it is most needed. Our approach can also aid in the formation of national as well as international networks using a technology that is fast, readily available and easy to use.

Here, we have presented new distributional data on the diving beetle fauna of Bali. Two new records for the island raise the total number of Dytiscidae species known from Bali to 34. In the future, it is our goal to compile a comprehensive faunistic review of the Balinese fauna using our approach.

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